



Knowledge, attitude and practice about pneumococcal immunization among elderly in Jeddah, Kingdom of Saudi Arabia

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Article History

Received: 15 October 2019

Reviewed: 16/October/2019 to 26/November/2019

Accepted: 28 November 2019

E-publication: 10 December 2019

P-Publication: March - April 2020

Citation

Ibrahim M Alyazidi, Mohammed Abdulrahman Basheikh, Salma Sait, Hadeel A Alharthy, Abdulrahman S Rihawi, Asrar A Alahmadi, Amal H Allohaibi, Ammar M Bahati. Knowledge, attitude and practice about pneumococcal immunization among elderly in Jeddah, Kingdom of Saudi Arabia. *Medical Science*, 2020, 24(102), 483-494

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General Note



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ABSTRACT

Background: Pneumonia is an infection in one or both lungs that can be caused by bacteria, viruses or fungi. Infection by *Streptococcus pneumoniae* (pneumococcus) in elderly adults or in those who have comorbidities and weak immunity can lead to significant health problems. Immunization against this infection plays a cost-effective role in the reduction of the burden of pneumonia on health. **Aim:** We aimed to determine the knowledge of and attitudes toward pneumonia and pneumococcal

vaccination in older adults in residential home care centers (RHCCs). *Methodology:* A cross-sectional study was conducted with an electronic interview questionnaire in RHCCs in Jeddah, Kingdom of Saudi Arabia (KSA) between June 23 and July 23, 2018. A total of 265 individuals were accepted for participation in the study. We excluded those who were under 18 years old, and the sample comprised 258 participants. *Result:* A total of 77.5% of participants confirmed that they did not receive the vaccine, 22.5% stated that they did not know which vaccine they received, and no participants reported that they received the vaccine. Approximately half of the sample did not know about the pneumonia vaccine. We observed positive attitudes toward vaccination among older adults, despite their significant lack of knowledge about the pneumococcal vaccine. *Conclusion:* Healthcare workers are the only individuals involved in the patient-physician relationship who play a critical role in distributing vaccine-related knowledge, and their recommendations of the vaccine are lacking. However, the respondents are willing to be informed about the vaccination.

1. INTRODUCTION

Pneumonia is an infection in one or both lungs that can be caused by bacteria, viruses or fungi (CDC, 2018). Among the many microorganisms that are responsible for pneumonia, the most common types of viral pneumonia are influenza and respiratory syncytial virus (RSV), and the most common bacterial type is *Streptococcus pneumoniae* bacterium (CDC, 2018). Infection by *Streptococcus pneumoniae* (pneumococcus) in elderly adults or in those who have chronic diseases or weak immunity can lead to significant health problems, such as bacteremia, meningitis, pneumonia or illness, such as otitis media (Jefferson & Demicheli, 2002). Pneumonia is a significant public health problem that causes morbidity and mortality among older adults, with 450 million people infected and approximately 4 million deceased from pneumonia per year globally (Ruuskanen et al., 2011). Most pneumonia cases and deaths occur in developing countries (WHO, 2008).

People aged 65 years and older with chronic illnesses favor the pneumococcal vaccination (Ridda et al., 2008). The Centers for Disease Control and Prevention (CDC) have confirmed the achievement of a 79-92% protection rate of the pneumococcal polysaccharide vaccine (PPV23) (Butler et al., 1993, Vila-Corcoles et al., 2006). By age group, PPV23 has a 75% protection rate for elderly adults aged 65 years or older with high immunity, 65% for patients with chronic respiratory diseases, 69% for patients with congestive heart failure, 73% for patients with coronary artery disease, and 84% for adults with diabetic conditions (MMWR Recomm Rep, 1997).

A previous study was conducted in Canada in 2014 on the knowledge, attitudes, beliefs and behaviors of older adults toward pneumococcal immunization. The results of this study indicated that healthcare providers' recommendations significantly influenced the manner in which older adults viewed vaccination (Schneeberg et al., 2014). Another study performed in Australia in 2008 reported that 295 out of 335 patients refused to receive the vaccine, which indicates poor attitudes and is one of the major barriers facing physicians (Petty, 2002). It is crucial to assess knowledge and attitudes toward pneumococcal immunization among older adults because it plays a cost-effective role in the reduction of the burden of pneumonia on health. There is a lack of research conducted in the Kingdom of Saudi Arabia (KSA) concerning older adults' knowledge of and attitudes toward pneumococcal immunization.

We aimed to evaluate the knowledge levels and attitudes of older adults in residential home care centers (RHCCs) toward pneumonia and pneumococcal vaccination in Jeddah, KSA.

2. METHODOLOGY

This study was approved by the research ethics committee of King Abdulaziz University Hospital (KAUH) on 13-May-2018, approval number (323-18). We conducted a cross-sectional study in RHCCs in Jeddah, KSA between June 23 and July 23, 2018, to determine older adults' knowledge of and attitudes toward pneumonia and immunization.

Participants included males and females aged 18 years and older. Exclusion criteria included a speaking disability and any cognitive problem. Verbal consent was obtained from participants. The total number of RHCCs was 18, and the number of residents in each home care ranged from 10-40. Data were collected using an interviewer-administered questionnaire. Verbal consent was obtained from the participants. All data collectors were trained and received a well-structured electronic questionnaire that translated information to Arabic with an intended interpreter. A cluster sample of 265 individuals was available in the RHCCs, but only 258 participants who met the inclusion criteria were included. Seven participants were excluded from further analysis because they were under the age of 18 years old.

The questionnaire consisted of two sections. The first section comprised demographic data, including sex, age, nationality and education level. Age was categorized into young adults (18-35 years), middle-aged adults (36-55 years), and older adults (above 55

years) (Petry, 2002). The questions from the second section measured participants' knowledge of pneumococcal pneumonia and immunization, perceived risk, personal normative beliefs, attitudes toward vaccines, facilitating conditions for vaccinations and respondent characteristics. Nine questions were rated on a six-point Likert scale with the following options: "strongly agree", "somewhat agree", "neither agree nor disagree", "somewhat disagree", "strongly disagree" and "I don't know". Six questions had the options of "yes", "no" and "I don't know". The following scores were given for each answer: "strongly agree" was given a score of 5, "somewhat agree" was given a score of 4, "neither agree nor disagree" was given a score of 3, "somewhat disagree" was given a score of 2, "strongly disagree" was given a score of 1, and "I don't know" was given a score of 0. Additionally, for questions with "yes", "no" and "I don't know" response options, responses were given a score of 1 for the correct answer and a score of 0 for the incorrect answer. A scoring system was created for the study's purpose of clarifying participants' views on pneumococcal vaccination.

Data entry was performed using Microsoft Excel 2014, and analysis was performed using the Statistical Package for the Social Sciences version 21. The chi-square test was used to determine the relationship between levels of education and knowledge and attitudes and the relationship between age group and knowledge and attitudes. P-values were considered significant if they were 0.05 or less. Frequency tests were used for all categorical data. Bar graphs were used to show age group and level of education in relation to levels of knowledge and attitudes.

3. RESULTS

This study aimed to assess knowledge of and attitudes toward pneumonia and pneumococcal vaccination. This was a descriptive cross-sectional study performed in RHCCs in Jeddah, KSA, between June 23 and July 23, 2018. A total of 265 individuals were accepted to participate in the study. We excluded those who were under the age of 18 years old, and the final sample comprised 258 participants. The mean age of the participants was 48.66 years, with a mod age of 60 years and a standard deviation (SD) of 17.423056 years. Significantly more women (80.2%) than men participated (Table 1).

Table 1: Demographic data				
		Young adults N (%)	Middle-aged adults N (%)	Older adults N (%)
Sex	Male	17 (6.6%)	15 (5.8%)	19 (7.4%)
	Female	50 (19.4%)	86 (33.3%)	71 (27.5%)
	Total	67 (26.0%)	101 (39.1%)	90 (34.9%)
Nationality	Saudi	15 (5.8%)	30 (11.6%)	17 (6.6%)
	Non-Saudi	52 (20.2%)	71 (27.5%)	73 (28.3%)
Highest level of education	Secondary School	10 (3.9%)	17 (6.6%)	9 (3.5%)
	High School	36 (14.0%)	23 (8.9%)	7 (2.7%)
	Illiterate	3 (1.2%)	25 (9.7%)	57 (22.1%)
	Primary School	6 (2.3%)	28 (10.9%)	16 (6.2%)
	University	12 (4.7%)	8 (3.1%)	1 (0.4%)

Data are presented in frequencies and percentages of individuals in each group. The total number of participants is 258. Young adults: 18-35 years old; middle-aged adults: 36-55 years old; and older adults: over 55 years old.

When participants were asked if they had received the pneumonia vaccine, 77.5% (200) answered no, 22.5% (58) stated that they did not know, and no participants reported that they had received the vaccine, despite there being several individuals at high risk of contracting pneumonia, including those who had diabetes (27.1%, n=70), hypertension (30.2%, n=78), CVD (11.6%, n=30), or asthma (14.3%, n=37) and those who were current smokers (15.1%, n=39).

A total of 55% (n=142) of participants were not aware of the pneumonia vaccine, and 13.6% (n=35) thought that the pneumonia vaccine was the same as the flu vaccine. A total of 84.1% (n=217) of the sample said that healthcare providers did not offer the pneumonia vaccine to them (Table 2). Most of the participants (60.5%, n=156) strongly agreed that pneumonia is a serious disease. A total of 77.9% (n=201) of the sample strongly agreed that vaccines are a sound way to protect one's health, and 58.5% (151) strongly agreed that receiving the pneumonia vaccine is a wise thing to do. However, 39.9% (103) did not know if they were at high risk of contracting pneumonia (Table 3).

Table 2: Responses to questions on knowledge, beliefs and facilitated conditions

		18 to 35 years old N (%)	36 to 55 years old N (%)	Above 55 years old N (%)	TOTAL N (%)
Knowledge Did you hear about a vaccine that prevents pneumonia?	Yes	12 (4.7)	21 (8.1)	12 (4.7)	45 (17.4)
	No	41 (15.9)	58 (22.5)	43 (16.7)	142 (55.0)
	I don't know	14 (5.4)	22 (8.5)	35 (13.6)	71 (27.5)
Is the pneumonia vaccine the same as the flu vaccine?	Yes	12 (4.7)	14 (5.4)	9 (3.5)	35 (13.6)
	No	30 (11.6)	27 (10.5)	20 (7.8)	77 (29.8)
	I don't know	25 (9.7)	60 (23.3)	61 (23.6)	146 (56.6)
Normative Does your doctor/healthcare provider think you should get the pneumonia vaccine?	Yes	1 (0.4)	13 (5.0)	9 (3.5)	23 (8.9)
	No	47 (18.2)	59 (22.9)	45 (17.4)	151 (58.5)
	I don't know	19 (7.4)	29 (11.2)	36 (14.0)	84 (32.6)
Did your doctor/healthcare provider offer you the pneumonia vaccine?	Yes	0 (0)	4 (1.6)	4 (1.6)	8 (3.1)
	No	61 (23.6)	90 (34.9)	66 (25.6)	217 (84.1)
	I don't know	6 (2.3)	7 (2.7)	20 (7.8)	33 (12.8)
Facilitating condition Do you have a regular doctor for primary care?	Yes	10 (3.9)	42 (16.3)	38 (14.7)	90 (34.9)
	No	57 (22.1)	59 (22.9)	52 (20.2)	168 (65.1)
	I don't know	NA	NA	NA	NA
Have you been to a hospital, emergency department or walk-in clinic in the last year?	Yes	43 (16.7)	82 (31.8)	63 (24.4)	188 (72.9)
	No	24 (9.3)	19 (7.4)	27 (10.5)	70 (27.1)
	I don't know	NA	NA	NA	NA

NA: Not Applicable. Young adults: 18-35 years old; middle-aged adults: 36-55 years old; and older adults: over 55 years old.

Table 3: *Study population responses to questions assessing knowledge, attitudes, and beliefs

	Age group	I don't know N (%)	Neither agree nor disagree N (%)	Some what agree N (%)	Some what disagree N (%)	Strongly agree N (%)	Strongly disagree N (%)
Knowledge Does the pneumonia vaccine protect a person from getting pneumonia?	18 to 35 years	18 (7)	0	6 (2.3)	2 (0.8)	40 (15.5)	1 (0.4)
	36 to 55 years	29 (11.8)	0	12 (4.7)	1 (0.4)	54 (20.9)	5 (1.9)
	Above 55 years	39 (15.1)	0	8 (3.1)	3 (1.2)	36 (14.0)	4 (1.6)
	TOTAL	86 (33.3)	0	26 (10.1)	6 (2.3)	130 (50.4)	10 (3.9)
Perceived risk Is pneumonia a serious disease?	18 to 35 years	12 (4.7)	2 (0.8)	2 (0.8)	1 (0.4)	49 (19.0)	1 (0.4)
	36 to 55 years	15 (5.8)	2 (0.8)	15 (5.8)	0	67 (26.0)	2 (0.8)
	Above 55 years	36 (14.0)	3 (1.2)	7 (2.7)	1 (0.4)	40 (15.5)	3 (1.2)
	TOTAL	63 (24.4)	7 (2.7)	24 (9.3)	2 (0.8)	156 (60.5)	6 (2.3)
Do you think you are at high risk of contracting pneumonia?	18 to 35 years	16 (6.2)	1 (0.4)	12 (4.7)	3 (1.2)	11 (4.3)	24 (9.3)
	36 to 55 years	37 (14.3)	2 (0.8)	14 (5.4)	3 (1.2)	23 (8.9)	22 (8.5)
	Above 55 years	50 (19.4)	1 (0.4)	6 (2.3)	1 (0.4)	11 (4.3)	21 (8.1)
	TOTAL	103 (39.9)	4 (1.6)	32 (12.4)	7 (2.7)	45 (17.4)	67 (26.0)
Normative Are your healthcare provider's recommendations important?	18 to 35 years	2 (0.8)	1 (0.4)	7 (2.7)	0	56 (21.7)	1 (0.4)
	36 to 55 years	2 (0.8)	0	11 (4.3)	0	87 (33.7)	1 (0.4)
	Above 55 years	3 (1.2)	3 (1.2)	2 (0.8)	0	82 (31.8)	0
	TOTAL	7 (2.7)	4 (1.6)	20 (7.8)	0	225 (87.2)	2 (0.8)

Attitude Do you think vaccines are a sound way to protect your health?	18 to 35 years	6 (2.3)	1 (0.4)	3 (1.2)	2 (0.8)	54 (20.9)	1 (0.4)
	36 to 55 years	5 (1.9)	2 (0.8)	6 (2.3)	3 (1.2)	81 (31.4)	4 (1.6)
	Above 55 years	16 (6.2)	3 (1.2)	5 (1.9)	0	66 (25.6)	0
	TOTAL	27 (10.5)	6 (2.3)	14 (5.4)	5 (1.9)	201 (77.9)	5 (1.9)
Do you consider vaccines to be safe?	18 to 35 years	7 (2.7)	0	7 (2.7)	2 (0.8)	48 (18.6)	3 (1.2)
	36 to 55 years	5 (1.9)	0	9 (3.5)	3 (1.2)	80 (31.0)	4 (1.6)
	Above 55 years	18 (7.0)	0	7 (2.7)	0	63 (24.4)	2 (0.8)
	TOTAL	30 (11.6)	0	23 (8.9)	5 (1.9)	191 (74.0)	9 (3.5)
Do you feel that getting the pneumonia vaccine is a wise thing to do?	18 to 35 years	13 (5.0)	0	7 (2.7)	1 (0.4)	42 (16.3)	4 (1.6)
	36 to 55 years	21 (8.1)	0	11 (4.3)	2 (0.8)	62 (24.0)	5 (1.9)
	Above 55 years	32 (12.4)	0	6 (2.3)	0	47 (18.2)	5 (1.9)
	TOTAL	66 (25.6)	0	24 (9.3)	3 (1.2)	151 (58.5)	14 (5.4)
Is it important for healthy adults over the age of 65 to get the pneumonia vaccine?	18 to 35 years	13 (5.0)	0	7 (2.7)	5 (1.9)	34 (13.2)	8 (3.1)
	36 to 55 years	33 (12.8)	0	9 (3.5)	2 (0.8)	44 (17.1)	13 (5.0)
	Above 55 years	47 (18.2)	0	8 (3.1)	1 (0.4)	31 (12.0)	3 (1.2)
	TOTAL	93 (36.0)	0	24 (9.3)	8 (3.1)	109 (42.2)	24 (9.3)
I consider the pneumonia vaccine to be safe	18 to 35 years	16 (6.2)	0	4 (1.0)	2 (0.8)	42 (16.3)	3 (1.2)
	36 to 55 years	28 (10.9)	0	5 (1.9)	1 (0.4)	63 (24.4)	4 (1.6)
	Above 55 years	43 (16.7)	0	7 (2.7)	1 (0.4)	39 (15.1)	0
	TOTAL	87 (33.7)	0	16 (6.2)	4 (1.6)	144 (55.8)	7 (2.7)

*Likert scale.

The participants who said that they did not receive the vaccine (n=200) were asked about their reasons for not being immunized. The most common answers were that their healthcare provider did not mention the pneumonia vaccine to them (63.2%, n=163), and 58.9% (n=152) of the participants responded that they did not have enough information to decide whether to be vaccinated (Table 4).

Table 4: Reasons for not being immunized					
		18 to 35 years old N (%)	36 to 55 years old N (%)	Above 55 years old N (%)	TOTAL N (%)
The doctor did not mention the vaccine to me	True	47 (23.5)	70 (35.0)	46 (23.0)	163 (81.5)
	False	12 (6.0)	11 (5.5)	14 (7.0)	37 (18.5)
Getting an appointment with a doctor or nurse was difficult	True	8 (4.0)	17 (8.5)	11 (5.5)	36 (18.0)
	False	51 (25.5)	64 (32.0)	49 (24.5)	164 (82.0)
I did not think I would become ill with pneumonia	True	19 (9.5)	34 (17.0)	25 (12.5)	78 (39.0)
	False	40 (20.0)	47 (23.5)	35 (17.5)	122 (61.0)
I think my body can fight pneumonia without the vaccination	True	25 (12.5)	28 (14.0)	13 (6.5)	66 (33.0)
	False	34 (17.0)	53 (26.5)	47 (23.5)	134 (67.0)
I do not think I need the pneumonia vaccine to protect my health	True	28 (14.0)	30 (15.0)	17 (8.5)	75 (37.5)
	False	31 (15.5)	51 (25.5)	43 (21.5)	125 (62.5)
I thought the vaccine would make me sick with pneumonia	True	7 (3.5)	6 (3.0)	4 (2.0)	17 (8.5)
	False	52 (26.0)	75 (37.5)	56 (28.0)	183 (91.5)
The possible side effects of the pneumonia vaccine worried me	True	12 (6.0)	18 (9.0)	8 (4.0)	38 (19.0)
	False	47 (23.5)	63 (31.5)	52 (26.0)	162 (81.0)
There was insufficient information to help me decide whether to get the vaccine	True	47 (23.5)	62 (31.0)	43 (21.5)	152 (76.0)
	False	12 (6.0)	19 (9.5)	17 (8.5)	48 (24.0)
I do not like needles	True	24 (12.0)	33 (16.5)	13 (6.5)	70 (35.0)
	False	35 (17.5)	48 (24.0)	47 (23.5)	130 (65.0)

We measured the participants' level of knowledge of the vaccine in association with their highest level of education using the chi-square test (p-value = 0.001474) and found a significant difference. The highest percentage of the participants who had

sufficient knowledge of the vaccine had middle-school, high-school and university levels of education (66.70% for each level), while most of the illiterate participants (62.40%) had low knowledge of the vaccine additionally, we found a significant difference in participants' attitudes toward the vaccine in association with their highest level of education (p -value = 0.000284). The highest percentage of participants who had positive attitudes toward the vaccine had university level educations (85.70%), while 51.80% of participants who were illiterate had poor attitudes toward the vaccine (Figure 1).

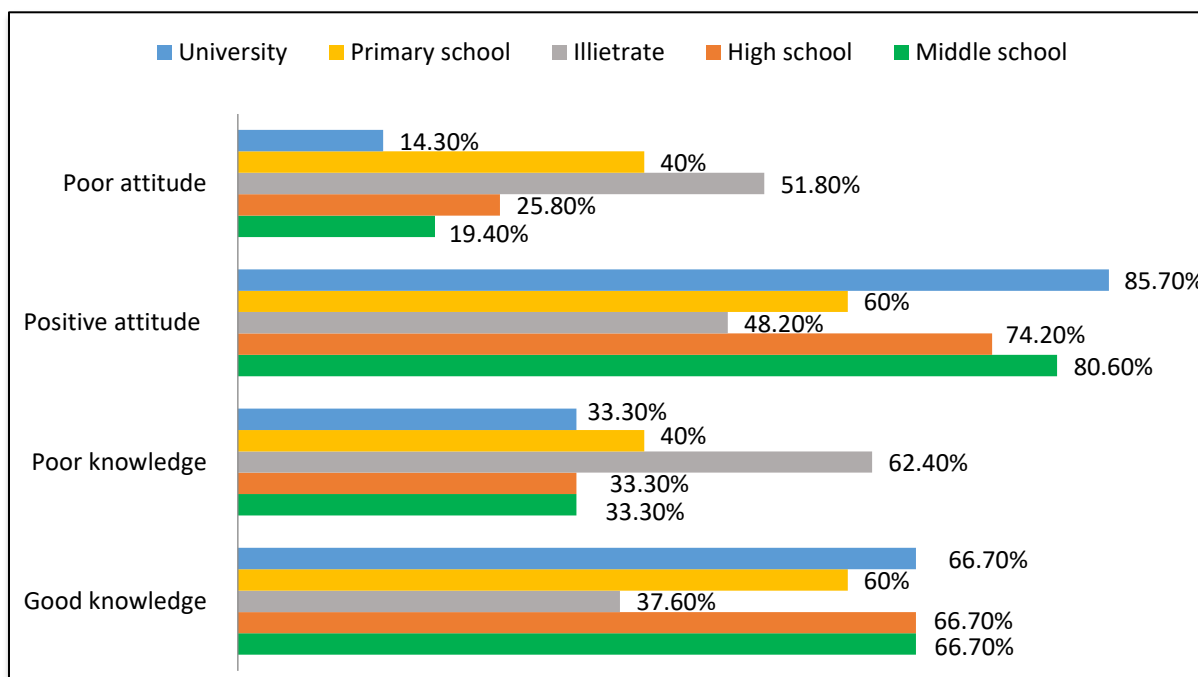


Figure 1 Participants' level of knowledge of the vaccine in association with their highest level of education

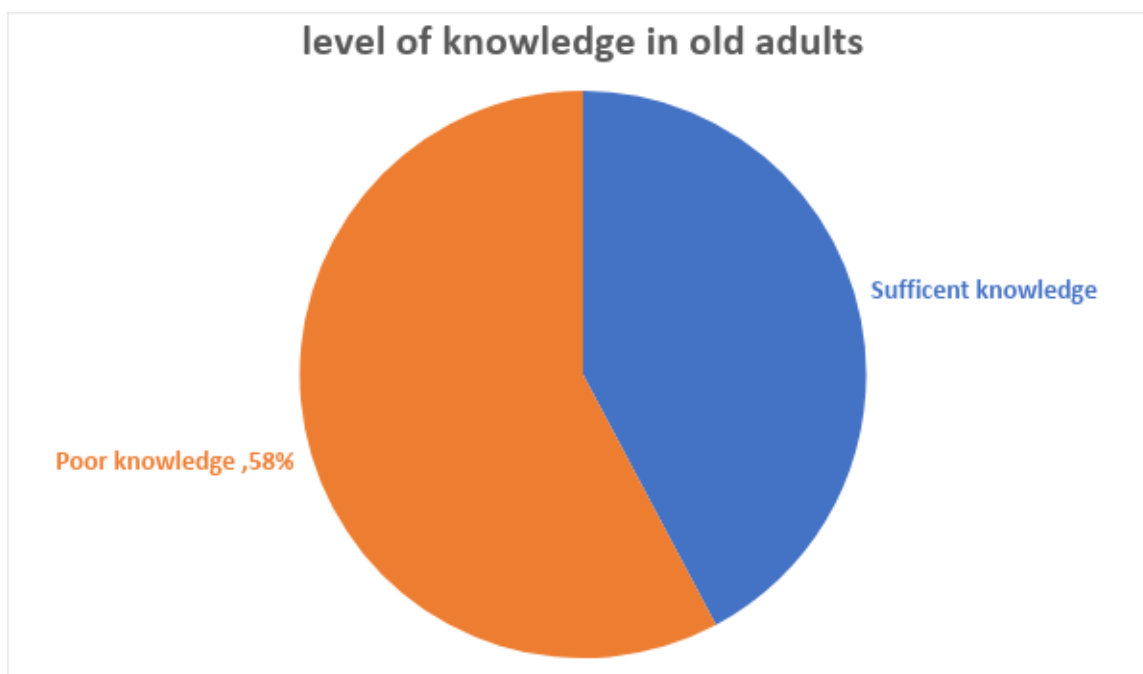


Figure 2 Level of knowledge about the vaccine among old adults (> 55 years)

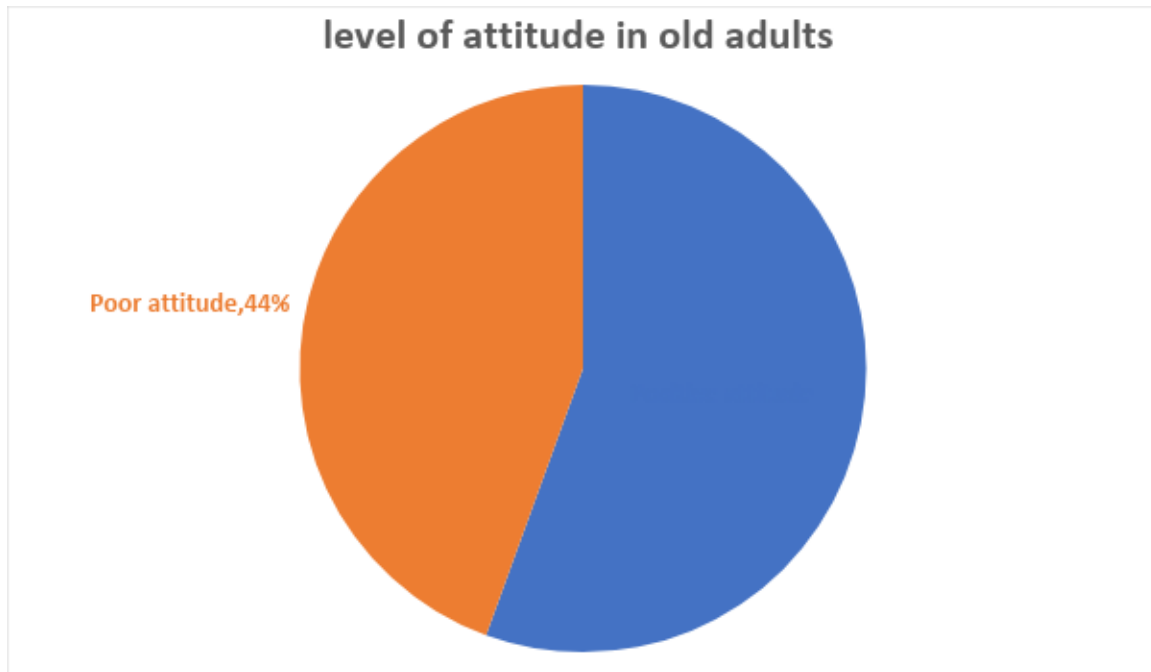


Figure 3 Level of attitude towards the vaccine among old adults (> 55 years)

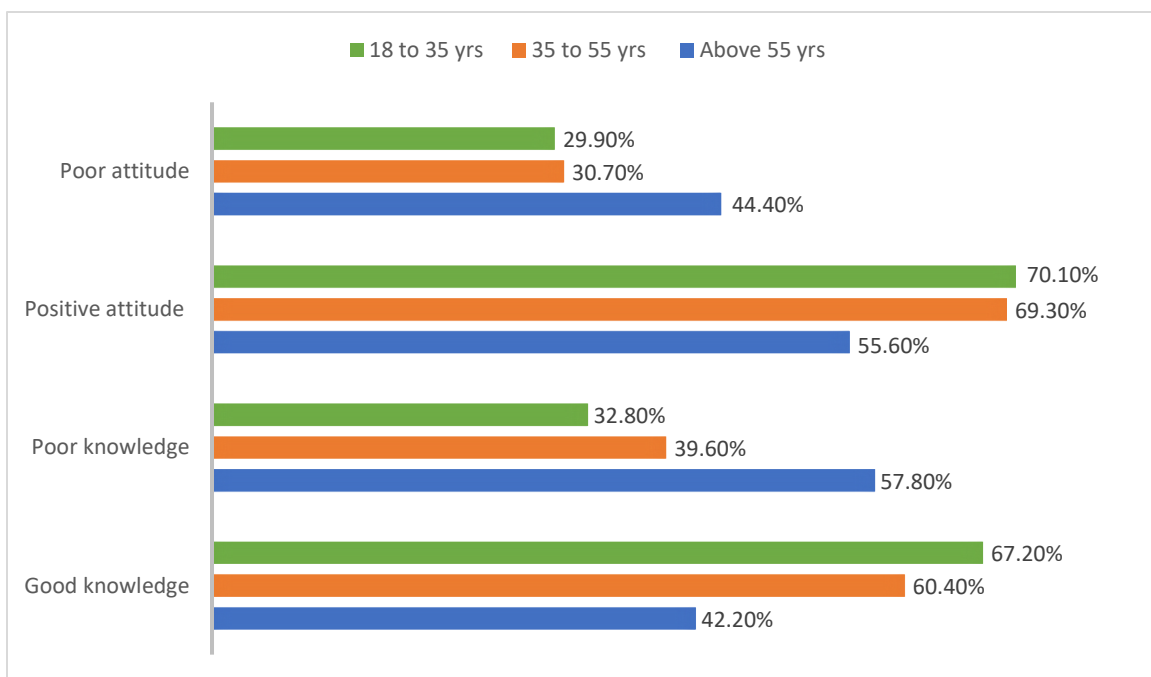


Figure 4 Participants' level of knowledge of the vaccine in association with their age

Additionally, we measured the participants' level of knowledge of the vaccine in association with their age group; 67.20% of the young adults (n=67) had sufficient knowledge, while 57.80% of the older adults (n=90) had low knowledge of the vaccine (p-value = 0.003885) as shown in (Figure 2), which was a significant finding. Additionally, we measured participants' attitudes toward the vaccine in association with their age group; 70.10% of young adults had positive attitudes toward the vaccine, while 44.40% of older adults had poor attitudes toward the vaccine (p-value = 0.077823) as shown in (Figure 3). However, this relationship was not significant, thus reflecting no relationship with pneumococcal immunization (Figure 4).

4. DISCUSSION

Pneumonia is a common health problem in the KSA and worldwide (*Memish et al., 2002*). The available data demonstrate that pneumonia is one of the most common problems in Mecca hospitals during the Hajj. However, there is generally a lack of research on the prevalence of pneumonia in the KSA or with a focus on vaccinations during the Hajj season, despite pneumonia being a serious disease that occurs during the year (*Al-Ghamdi et al., 2003*). To our knowledge, this is the first study to assess knowledge and attitudes toward pneumococcal vaccination among individuals in RHCC in Jeddah, KSA.

We found that 200 (77.5%) participants were unvaccinated; on the other hand, the remaining 58 (22.5%) participants stated that they did not recall which vaccines they received. In Canada, 58% of the participants said that they were immunized against pneumonia (*Schneeberg et al., 2014*).

A study conducted in Canada found that only 26% of their respondents heard about the pneumococcal vaccine but not from their healthcare provider (*Schneeberg et al., 2014*). However, in this study, the most frequently reported reasons for why the participants were not immunized was because their healthcare providers did not mention the pneumococcal vaccine to them (81.5% of the sample), and 76% of the participants did not have enough information to decide whether to receive the vaccine or not. This finding was unexpected because a high number of patients in our study had comorbidities, but healthcare providers still did not offer them the vaccine. In 2018, the USA guidelines recommended that patients aged 65 years or older with comorbidities should receive the pneumococcal vaccine, and according to the Ministry of Health in the KSA, vaccines are an easily accessible way for all people to avoid contracting infectious diseases (*CDC, 2018, Frayha & Al Mazrou, 2005*).

In this study, we found that 87.2% of the respondents strongly agreed that their healthcare provider's recommendations are important. Similarly, a study conducted in Australia found that 81% of their participants would not accept the vaccine if their general physician did not recommend it (*Ridda et al., 2008*). Therefore, we concluded that healthcare providers play a major role in educating their patients regarding pneumococcal vaccination.

Our study highlighted that the level of knowledge increases with an increasing level of education, which is to be expected, despite the fact that the majority of older adults in our sample were illiterate. When patients have a higher level of education, their awareness of health issues will increase; this relationship has been supported by a study conducted in Australia, which showed that people with a high level of education have a more health-oriented lifestyle and attitude (*Johnston et al., 2015*).

We also noticed that age increases, knowledge about pneumococcal vaccination decreases. The older adults in our sample had a low level of knowledge about the pneumococcal vaccination since they were illiterate. A study conducted in China showed that awareness decreases with increasing age, and awareness increases with increasing levels of education level and income (*Xiaodong et al., 2016*). In addition, individuals in the RHCCs had low socioeconomic status (LSES), which is consistent with findings from a previous study conducted in Pakistan reporting that a lack of significant knowledge about pneumonia and its vaccine was observed more commonly among those with an LSES background than among those with a high socioeconomic status (HSES) background (*Baig et al., 2014*).

In China, participants with high levels of education and high incomes have sufficient knowledge of the vaccine, but surprisingly, the attitudes regarding PPV23 were poor, and these participants would not seek an opportunity to receive the vaccination (*Xiaodong et al., 2016*). Conversely, the majority of the participants had poor knowledge, but they had positive attitudes toward receiving the vaccination. However, positive attitudes are not enough; individuals need more information regarding disease complications and the vaccine. Another explanation could be related to the way in which the questionnaire was designed, which may have affected the answers of the participants in our sample, although we trained our data collectors before the data collection.

5. CONCLUSION

We observed a significant deficiency in older adults' knowledge about the pneumococcal vaccination, and most of them had positive attitudes toward the vaccination. Healthcare workers are the only group involved in the patient-physician relationship; thus, they play a critical role in distributing vaccine-related knowledge, but their recommendations of the vaccine are lacking. Nonetheless, the respondents are willing to be informed about the vaccination.

Recommendation

When people receive influenza vaccines it is common for them to receive pneumococcal vaccines simultaneously. We believe that it is opportune for healthcare workers to offer pneumococcal vaccines to patients receiving their annual influenza vaccination; this strategy would help to increase the rate of immunization.

We believe that it is essential for healthcare workers to recommend the pneumonia vaccine to patients to increase the rate of pneumococcal immunization. Therefore, healthcare workers need to pay more attention to vulnerable groups. It is very important to increase awareness about the disease and its vaccination, especially among older adults and people with LSES backgrounds, through awareness campaigns. Posters should be displayed year round in clinics, wards and general practitioners' offices, and efforts should be made to complete periodic vaccination programs.

Limitations

We experienced difficulty in contacting the RHCCs, since there is no registry with their contact information or locations. Additionally, when we started the data collection, we were surprised that all of our participants were unvaccinated, and we were not able to perform a comparison between the two groups. All of our data collectors were bilingual in both Arabic and English, but the RHCCs had individuals of multiple nationalities who spoke other languages. Similarly, the variability in the accents of participants of different Arabian races was challenging.

Participants' answers were collected in the form of an interview, but some participants were sick and could not complete the interview. In addition, the relatively small sample size may affect the accuracy of the results. The sex difference in our sample could be attributed to the completion of data collection during the hours in which several male residents were working.

Funding

No funding was received for this study.

Conflicts of interest

All authors have no conflicts of interest to manipulate the findings.

Acknowledgments

We would like to thank the Road of Change summer school research program for supporting our study. We would also like to thank Abdullah Alawadi and AbdulazizRagi Alotaibi for collecting the data.

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